

**Regional Electricity Cooperation
and Strategic Infrastructure (RECSI)**

WESTERN REGION
Summary
FOR POLICY MAKERS

WR-SPM



Aussi disponible en français sous le titre :
Initiative de collaboration régionale et d'infrastructure stratégique
de l'électricité (RECSI) Région de l'Ouest – Résumé à l'intention
des responsables des politiques.

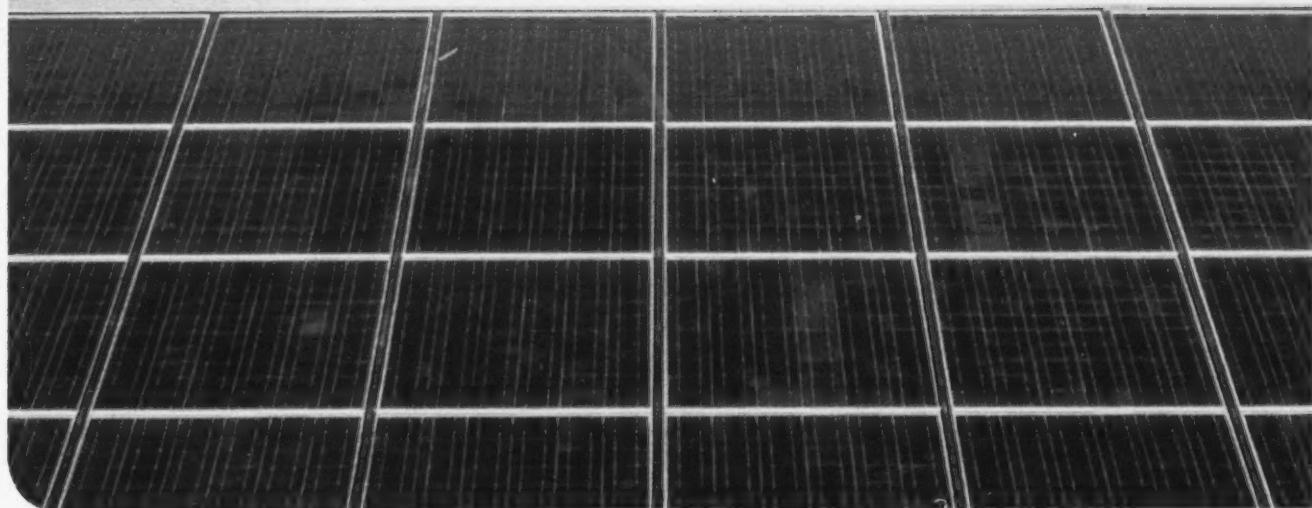
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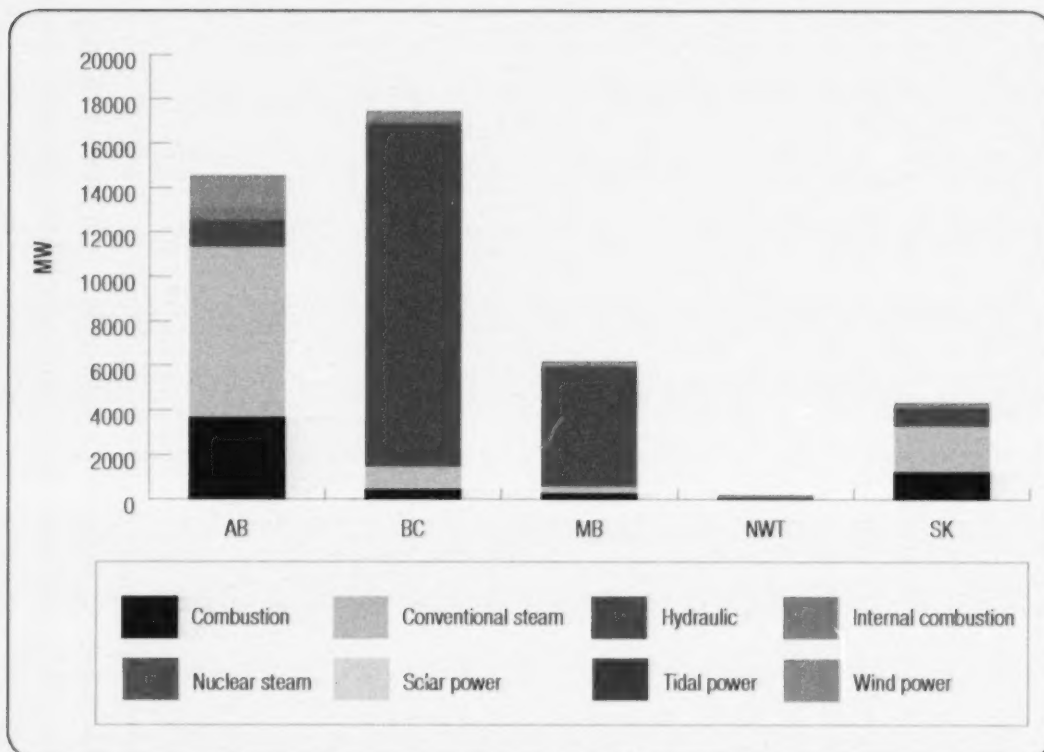
WR-SPM.1 Purpose and context

The Summary for Policy Makers (SPM) of the western dialogue on Regional Electricity Cooperation and Strategic Infrastructure (RECSI) provides a summary of the findings from an economic modelling simulation study. Natural Resources Canada (NRCan) sponsored the study in collaboration with the governments of the Northwest Territories (N.W.T.), British Columbia (B.C.), Alberta, Saskatchewan and Manitoba. The respective provincial electricity system operators, BC Hydro, Alberta Electric System Operator (AESO), SaskPower and Manitoba Hydro, contributed relevant knowledge, data and expertise to construct the economic simulation model.

WR-SPM.1.1 Pan-Canadian Framework on Clean Growth and Climate Change

The Pan-Canadian Framework on Clean Growth and Climate Change (PCF) presents a collective plan to grow the economy while reducing emissions and adapting to a changing climate. Published in December 2016, the PCF outlines a collaborative action plan to meet or exceed Canada's 2030 target of a 30% reduction below 2005 levels of greenhouse gas (GHG) emissions. Achieving, or exceeding, the target reduction in GHG emissions would require changes to the production and use of energy, including electricity.

Electricity generation in Canada is predominantly from non-emitting sources. About 80% of electricity is generated from non-emitting sources, with some regional variation due to provincial natural endowments (see Figure 1). Because electricity is Canada's fourth-largest source of GHG emissions, the PCF outlines specific actions to transform regional electricity systems. These actions include increasing the amount of electricity generated from renewable and low-emitting sources; connecting clean power with places that need it; modernizing electricity systems; and reducing reliance on diesel, working with Indigenous people and northern and remote communities.

Figure 1. Western, RECSI-Installed generating capacity, by turbine class, 2016

Source: Statistics Canada, CANSIM Table 127-0009, adjusted to megawatts

Connecting clean power with places that need it required a regional electricity perspective. Electricity generation and transmission are provincial responsibilities. To determine the potential for interprovincial electricity collaboration, the federal government sponsored regional dialogues to identify promising electricity infrastructure projects that can connect clean power with places that need it.

WR-SPM.1.2 Investing in Canada plan

The federal government has committed to investing in infrastructure. The federal government is investing more than \$180 billion over 12 years in five priority infrastructure streams: public transit, green, social, trade and transportation, and rural and northern communities. Funding will come through several national programs, negotiated agreements with provinces and through the Canada Infrastructure Bank.

The green infrastructure stream funds could support new electricity generation and transmission projects that connect clean power to places that need it.

Through integrated bilateral agreements (IBA), provinces, territories and the federal government could allocate green stream funds to support the construction of electricity transmission lines to bring clean power to a neighbouring province or territory. The green infrastructure stream funding allocation for the provinces are B.C. – \$1,120M¹; Alberta – \$1,000M²; Saskatchewan – \$420M³; Manitoba – \$450M⁴; and the N.W.T. – \$210M.⁵

The Canada Infrastructure Bank (CIB) seeks to mobilize private capital to support federal policy goals. The CIB is a federal Crown corporation that will use federal support to attract private sector and institutional investment to new revenue-generating infrastructure projects that are in the public interest. Operating like a merchant or investment bank, the CIB will structure appropriate financial support for projects as a business model with its partners.

WR-SPM.1.3 A regional perspective could identify promising infrastructure projects

Alberta and Saskatchewan rely on coal-fired electricity generation and have announced plans to transition to a more renewable generation mix.^{6,7} B.C. and Manitoba have significant hydropower resources that could assist Alberta and Saskatchewan with this transition and help expand the use of electricity in place of fossil fuels. These hydro resources not only offer energy but could also offer energy storage services, which can help with the integration of variable renewables, such as wind. A regional modelling approach was necessary to understand the potential benefits of new renewable generation sources and to reinforce existing limited interprovincial interconnections as a strategy for western Canada to transition to a cleaner electricity future.

A regional study could identify promising electricity infrastructure projects in western Canada. As part of Green Infrastructure Phase I spending, the federal government allocated \$2.5 million to advance regional electricity cooperation by funding studies and dialogues to identify promising infrastructure projects with the potential to achieve significant GHG reductions. The governments of B.C., Alberta, Saskatchewan, Manitoba and the N.W.T., with BC Hydro, AESO, SaskPower, and Manitoba Hydro, collaborated on a regional economic dispatch simulation model. The purpose was to assess the relative cost-effectiveness of various electricity generation and transmission projects to reduce GHG emissions.

1 www.infrastructure.gc.ca/plan/letters-lettres/pt-bc-eng.html

2 www.infrastructure.gc.ca/plan/letters-lettres/pt-bc-eng.html

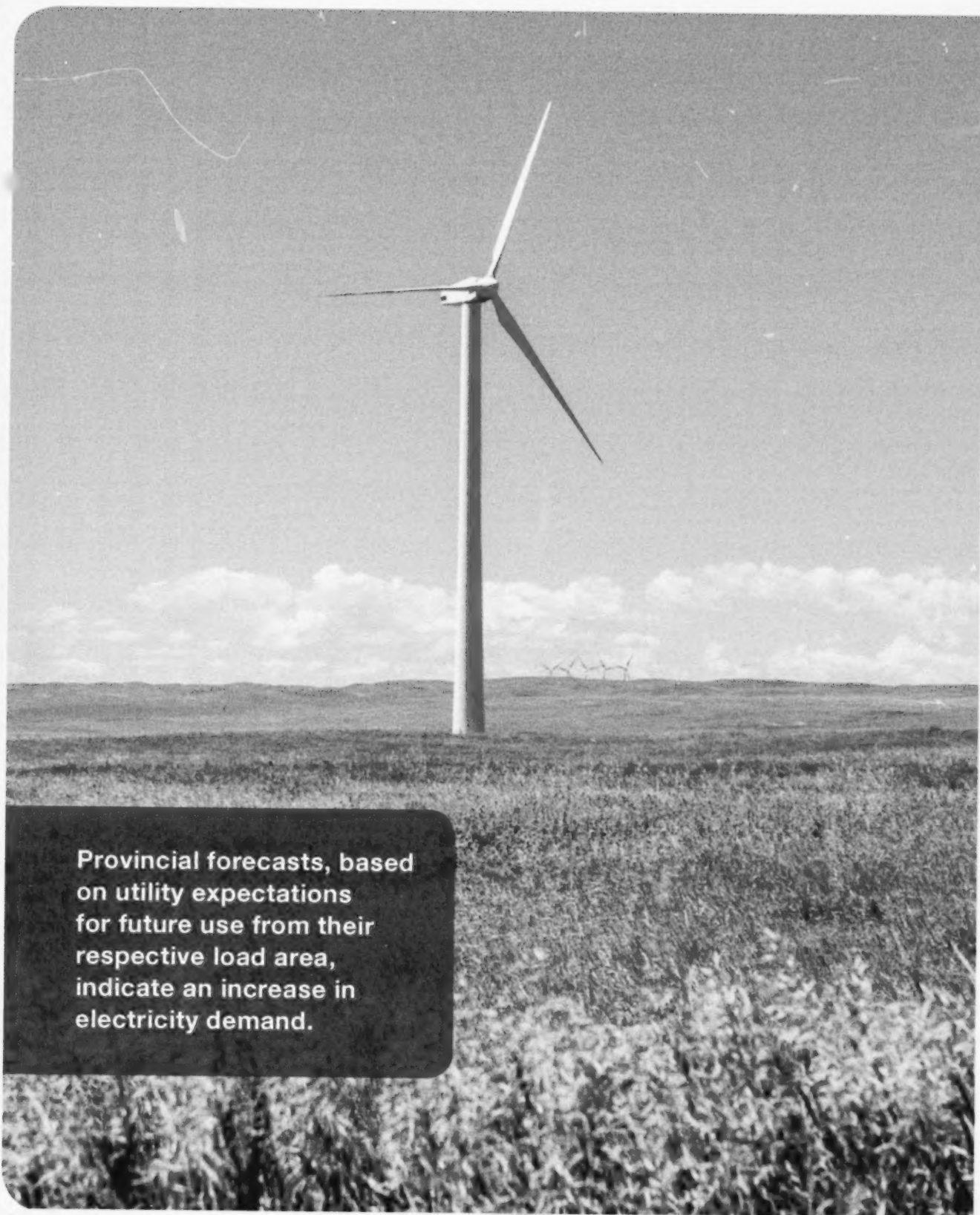
3 www.infrastructure.gc.ca/plan/letters-lettres/pt-sk1-eng.html

4 www.infrastructure.gc.ca/plan/letters-lettres/pt-mb-eng.html

5 www.infrastructure.gc.ca/plan/letters-lettres/pt-nt-eng.html

6 www.alberta.ca/climate-leadership-plan.aspx

7 www.saskpower.com/our-power-future/our-electricity/electrical-system/renewables-roadmap



Provincial forecasts, based on utility expectations for future use from their respective load area, indicate an increase in electricity demand.

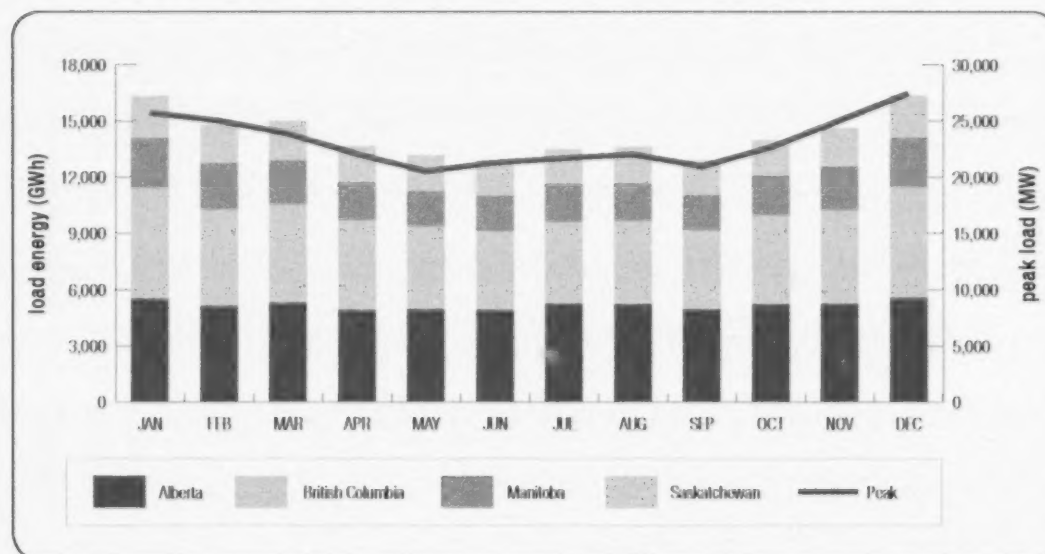
WR-SPM.2 Western regional electricity context

In general, electricity trade and other market operations between jurisdictions can provide cost benefits from better sharing of generation resources and can improve stability and reliability for their respective grids. The recent seasonal capacity sharing agreement between Ontario and Quebec is a good illustration of these benefits.⁸

WR-SPM.2.1 Future electricity demand

Demand for electricity will increase. Provincial forecasts, based on utility expectations for future use from their respective load area, indicate an increase in electricity demand. Each province regularly updates their future electricity demand to ensure the future availability of generation resources.

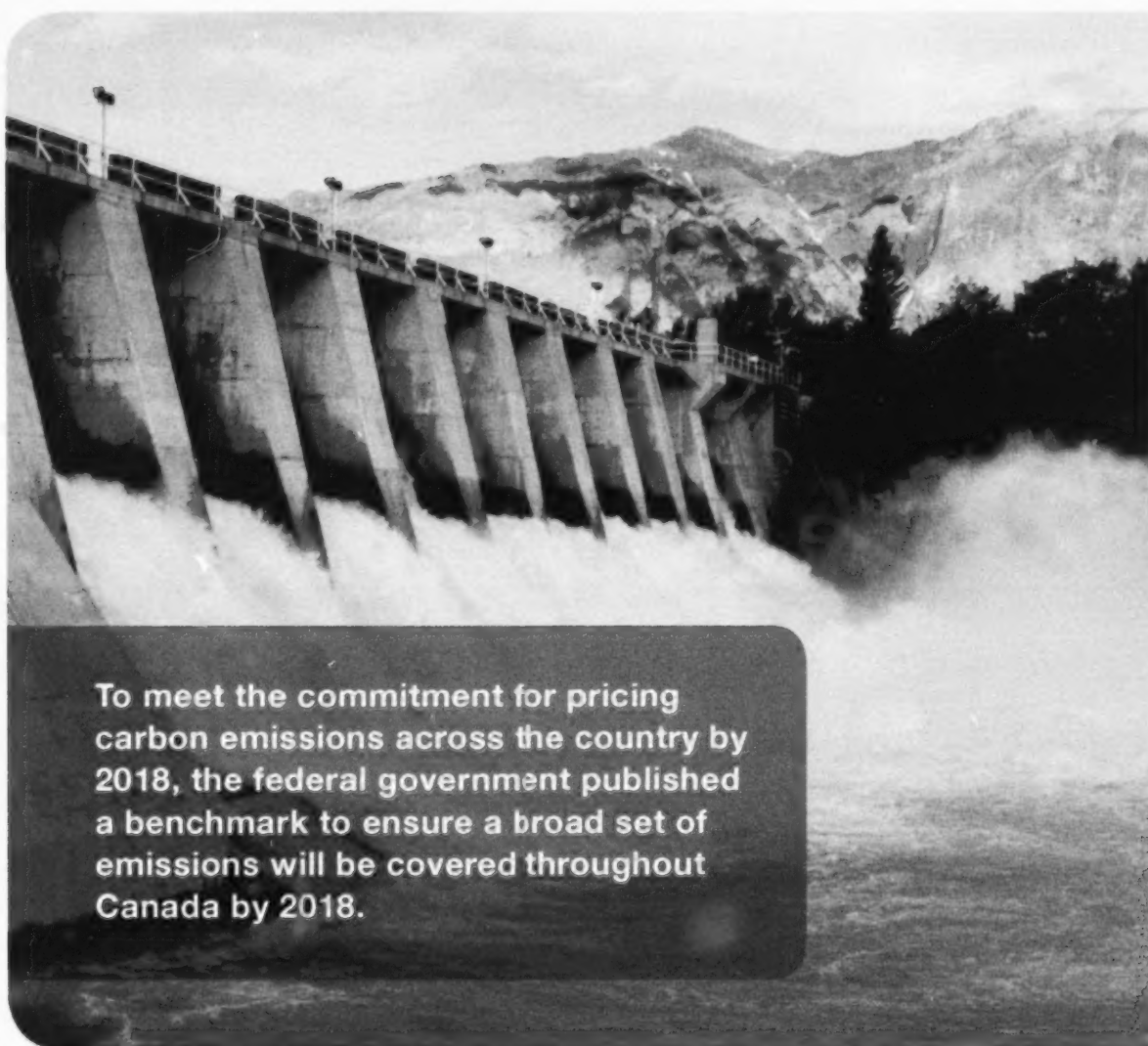
Figure 2. 2030 annual load curve



Source: GE Western RECSI technical report

WR-SPM.2.2 Western region electricity market structures

The western provinces have different market structures. B.C., Saskatchewan, Manitoba and the N.W.T. have regulated vertically integrated electric utilities. Alberta, through AESO, operates a wholesale “energy-only” electricity market and is transitioning to a capacity market construct. The different markets use different tools to influence the type of electricity generation brought onto their respective electric system. Investment decisions in competitive wholesale markets are driven mainly by profit considerations. However, those taken in regulated markets tend to be more strongly influenced by provincial policy objectives, subject to oversight by an independent public interest regulator.



To meet the commitment for pricing carbon emissions across the country by 2018, the federal government published a benchmark to ensure a broad set of emissions will be covered throughout Canada by 2018.

WR-SPM.3 Federal policies will change the regional electricity system

The Canadian Environmental Protection Act, 1999 articulates the federal government's duties to protect the environment from any adverse effects from the release of pollutants, such as air pollution in the form of greenhouse gas emissions.⁹

WR-SPM.3.1 Accelerating the retirement of coal-fired generation of electricity

Coal-fired electricity generation regulations are changing to accelerate their retirement. The proposed amendments are named *Regulations Amending the Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations*. They will accelerate compliance of coal-fired units to a performance standard of 420 tonnes of carbon dioxide per gigawatt hour (CO₂/GWh) by 2030. Draft regulations were published for public comment in 2018; final regulations are expected to be published at the end of 2018.

This new regulation will hasten a permanent shift to lower- or non-emitting types of generation, such as high-efficiency natural gas and renewable energy. In some cases, as in Alberta and Manitoba, provincial governments have already announced intentions to retire conventional coal-fired units.

WR-SPM.3.2 Federal backstop to carbon pricing

The federal government will ensure provincial compliance on instituting a carbon price. To meet the commitment for pricing carbon emissions across the country by 2018, the federal government published a benchmark to ensure a broad set of emissions will be covered throughout Canada by 2018. The benchmark allows provinces and territories flexibility to implement their own carbon pricing systems, if they do not already have a carbon price in place. To ensure compliance, the federal government committed to implementing a federal backstop to provincial efforts to implement measures to price carbon emissions.

⁹ <http://laws-lois.justice.gc.ca/eng/acts/c-15.31/>

WR-SPM.3.3 Regulating natural gas-fired generation of electricity

The federal government is developing regulations to limit CO₂ emissions from new and modified natural gas-fired generation units. The proposed regulation seeks to limit CO₂ emissions from new and significantly modified natural gas-fired electricity generation units in Canada. Environment and Climate Change Canada (ECCC) published performance requirements that vary by technology type and size.¹⁰ Draft regulations were published for public comment in 2018; final regulations are expected to be published at the end of 2018.

WR-SPM.3.4 Emissions equivalency agreements with provinces

The federal government could negotiate equivalency agreements with provinces related to emissions. Under section 10 of the Canadian Environmental Protection Act, 1999, the federal minister may enter into an equivalency agreement with provinces and territories provided the provincial or territorial regulations deliver equivalent or better outcomes than federal regulations. For example, the *Order Declaring that the Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations Do Not Apply in Nova Scotia (SOR/2014-265)* demonstrates an alternate method to achieving equivalent CO₂ reductions.¹¹

Saskatchewan and ECCC have an Agreement in Principle with respect to equivalency on the existing coal-fired electricity regulations. The agreement would consider the electricity sector as a whole.¹²

¹⁰ For full criteria and performance requirements, review the full *Canada Gazette* notice: Regulations Limiting Carbon Dioxide Emissions from Natural Gas-fired Generation of Electricity.

¹¹ www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/agreements/equivalency/canada-nova-scotia-greenhouse-gas-emissions.html

¹² www.ec.gc.ca/default.asp?lang=En&n=DF9C1A4C-1&offset=1&toc=show%23X-2017022815060985#X-2017022815084473

WR-SPM.4 Provincial policies will change the regional electricity system

As recognized in section 92A of the Canadian Constitution, each province may exclusively make laws governing the generation and production of electrical energy.¹³

WR-SPM.4.1 British Columbia's Clean and Renewable Energy

B.C.'s electricity system is over 98% clean. With its clean electricity, BC Hydro is able to support decarbonization across sectors and jurisdictions including the electrification of upstream natural gas and liquefied natural gas (LNG) production, allowing B.C. to be the exporter of the cleanest LNG in the world.

WR-SPM.4.2 Alberta's Climate Leadership Plan

Alberta's Climate Leadership Plan includes, among other items, an end to pollution from coal-generated electricity, a commitment to develop more renewable energy and a price on GHG emissions. Alberta has committed to end pollution from coal-generated electricity by the end of 2030. The reduction in pollution will not only assist the province reduce GHG emissions but also should benefit air quality and a number of health conditions. To replace the coal generating capacity, Alberta has committed to supply 30% of its electricity from renewable sources such as wind, hydro and solar by 2030.

To support reducing emissions and to transition to a lower-carbon economy, Alberta introduced a carbon levy on combustible fuels and set sector-specific benchmarks for emissions performance under the *Carbon Competitiveness Incentive Regulation*. Revenue from the carbon levy will pay for initiatives such as, but not limited to, renewable energy projects.

¹³ <http://laws-lois.justice.gc.ca/eng/Const/page-4.html#h-19>

WR-SPM.4.3 Saskatchewan's Climate Change Strategy

Saskatchewan's Climate Change Strategy includes a commitment to manage emissions from electricity and sets a target of up to 50% renewable generation by 2030. Regulating emissions from electricity generation, coupled with a commitment of providing up to 50% of capacity from renewables such as solar and wind, will change the electricity generation mix significantly.

WR-SPM.4.4 Manitoba's Climate and Green Plan

Manitoba's Climate and Green Plan includes a carbon price and energy efficiency measures. Manitoba has committed to implementing a carbon price that could lead to greater use of their abundant supply of hydro electricity. Energy efficiency measures could also lead to a change in power flows across the electric grid.

WR-SPM.4.5 N.W.T. Climate Change Strategic Framework

The N.W.T.'s Climate Change Strategic Framework includes a commitment to reduce GHG emissions by 2030. The Climate Change Strategic Framework and 2030 Energy Strategy outline a path that includes reducing GHG emissions from diesel generation by 25% and increasing the use of renewable energy for community heat to 40% by 2030. The Taltson hydroelectric project will support these efforts.

WR-SPM.5 Modelling potential projects for the regional electric system

An electric system economic simulation model can be used to identify the most cost-effective means in which to manage a change to a system. A comparative analysis, often between possible future scenarios with a reference case (usually described as a business-as-usual (BAU) case), estimates the costs and benefits of new infrastructure builds such as new transmission lines and/or new sources of generation.

WR-SPM.5.1 Business-as-usual

The BAU reference case was based on the latest planning documents from each respective system operator.

Each utility or system operator used their most recent long-term planning document to inform the BAU case.

WR-SPM.5.2 Description of projects

The respective jurisdictions investigated a suite of possible energy generation and transmission projects that were then compared against the BAU reference case to determine the change impact. Each project was modelled separately against the reference case so that the impacts of each project could be identified. The projects investigated were:

Project A – Two options for a new intertie between B.C. and Alberta. Two siting options were investigated, a northern and southern route.

Project B – Three options of a new intertie between Manitoba and Saskatchewan were investigated: a 500-kilovolt (kV) line and two options of a 230 kV line.

Project C – Transmission lines were added separately to support more renewables in both Alberta and Saskatchewan. These transmission projects were internal to both provinces.

Project D – Different hydro resources with associated transmission lines were added to Alberta and Saskatchewan.

Project E – Coal units in Alberta and Saskatchewan were converted to either combined cycle natural gas units or to carbon capture and storage units for operation in 2030.

Project F – Bulk storage units in Alberta and Saskatchewan were added, either compressed air energy storage or utility-scale battery technology.

Project G – Transmission and wind generation sources were added to support both the upstream natural gas processing industry and the downstream LNG industry in B.C.

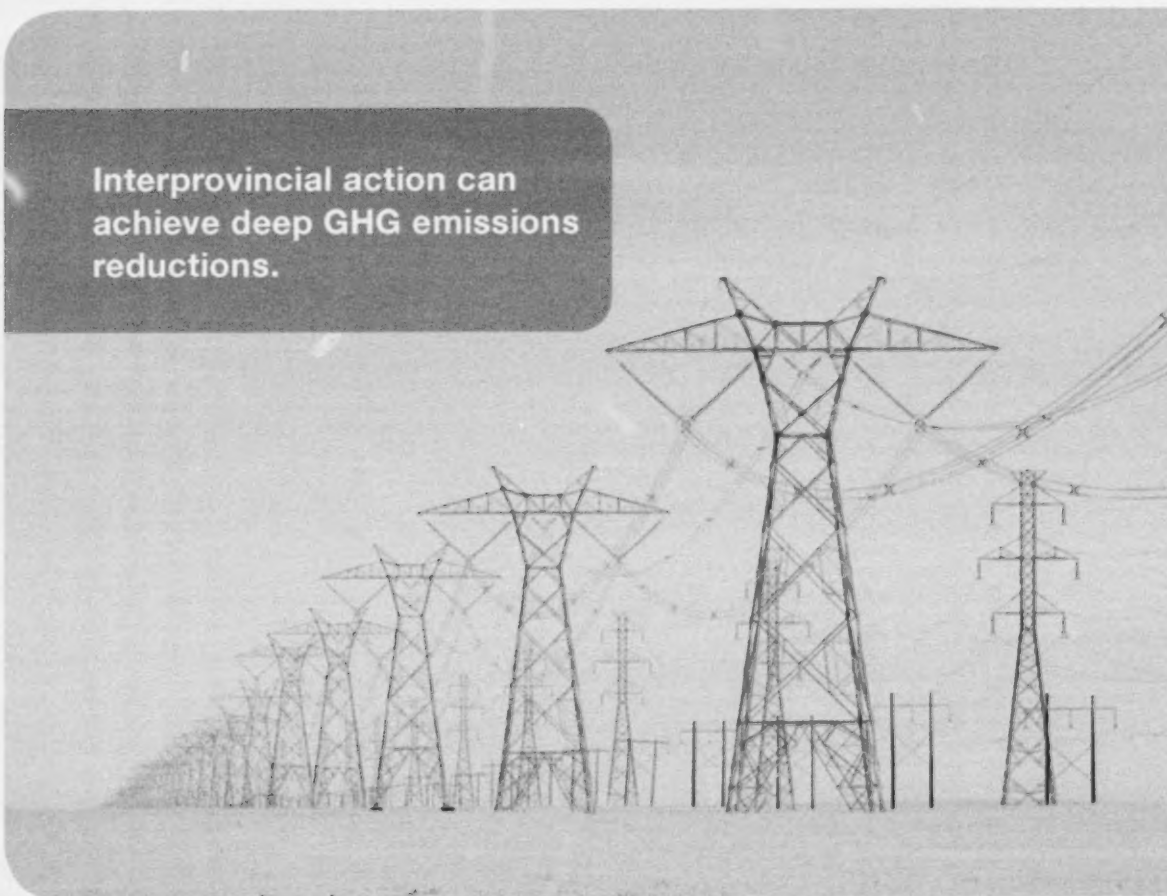
Project H – A hydro project with associated transmission in the N.W.T.

Project I – A new direct current line between Alberta and Saskatchewan

Project J – Restoring the existing Alberta-B.C. intertie to its full transfer capacity

Project K – A combination of projects A and C

Interprovincial action can
achieve deep GHG emissions
reductions.



WR-SPM.6 Key findings

There are several transmission projects in western Canada that can both reduce GHG emissions and lead to overall electricity production cost savings. These win-win projects include Project J and several options of projects B and G (see Table 1). Such projects effectively reduce carbon while also reducing costs for the utilities.

Interprovincial action can achieve deep GHG emissions reductions. The interprovincial transmission projects examined could offer GHG emissions reductions in the range of 0.5 megatonnes (Mt) to 1.2 Mt per year.

Electrification of LNG and upstream natural gas production is a particularly compelling GHG reduction opportunity. The study found significant potential for GHG reduction from electrification of these projects.

Alberta and Saskatchewan have a number of options to pursue to reduce their respective electricity sector GHG emissions. The modelling results indicate a number of project types offer promise to reduce electricity sector GHG reductions, as indicated in Table 1.

Table 1. RECSI project GHG emissions reductions and costs

Project or option	Net annual cost change (\$ million)	Carbon emissions change (million tonnes)	Net annual cost change per unit of change in carbon emissions (\$/tonne)
A1: B.C.-Alta. intertie North	72.36	-1.12	-64.61
A2: B.C.-Alta. intertie South	49.97	-0.86	-58.11
B1: New intertie Man-Sask.	87.19	-1.19	-73.27
B2A: New intertie Man-Sask.	-5.73	-0.45	12.73
B2B: New intertie Man-Sask.	-16.93	-0.41	41.29
C1: Alta. internal transmission	146.42	-1.93	-75.87
C2: Sask. internal transmission	14.47	0.00	0.00
D1: Peace River Hydro	217.31	-0.61	-354.21
D2: Tazi Twe Hydro	62.56	-0.16	-381.75
D3: Brazeau Hydro	451.98	-1.76	-256.30
D4: Tazi Twe Hydro	47.98	-0.37	-128.35
E1: CC in Alta. in 2030	916.02	2.11	434.13
E2: CCS in Sask. in 2030	663.34	-6.89	-96.28
E3: CC in Sask. in 2030	321.01	-6.06	-52.97
F1: CAES in Alta.	332.10	-1.88	-176.65
F2: Battery in Sask.	-12.05	0.21	-57.36
G1: Electrify gas in B.C.	-41.15	-2.59	15.89
G2: Electrify gas in B.C.	-43.26	-3.47	12.47
G3: Electrify LNG in B.C.	-32.03	-2.12	15.11
G4: Electrify LNG in B.C.	70.25	-5.19	-13.54
H: N.W.T. Hydro	58.89	-0.28	-207.73
I: Intertie between Alta. and Sask.	-13.36	0.40	-33.39
J: Restore existing B.C.-Alta. intertie to full capacity	-37.14	-0.51	72.82
K1: Combined project A north and C	258.37	-2.71	-95.34
K2: Combined project A south and C	227.10	-2.50	-90.84

Green:	Carbon emissions decreased and annual costs decreased (win-win)
Blue:	Carbon emissions decreased and annual costs increased (win-lose)
Yellow:	Carbon emissions increased and annual costs decreased (lose-win)
Red:	Carbon emissions increased and annual costs increased (lose-lose)

Source: Western Regional Electricity Cooperation and Strategic Infrastructure (RECSI) Study prepared by GE Energy Consulting

WR-SPM.7 Next steps

The highest potential projects may be further examined by the appropriate utilities or system operator. NRCan may work with interested provinces to investigate any high potential projects. NRCan will continue to work with SaskPower and Manitoba Hydro to explore further the benefits of increased intertie capacity as outlined in Project B.

New federal programs can expand renewable energy deployment in the region. NRCan launched new national programs under Green Infrastructure Phase II. These include, but are not limited to, the Smart Grid and Emerging Renewable Power programs. NRCan will work with the western provinces to implement projects under these program streams.

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